ABSTRACT

A thermodilution catheter having a heating filament which is fabricated so as to be thin and flexible enough to avoid contact with the patient's blood. The heating filament is either inserted in a preformed catheter lumen, incorporated into a wall of the catheter body itself, or wrapped around the catheter body wall and surrounded by an external sheath. Generally, the covering of the heating filament is minimally thin so as to allow the heat from the heating filament to be transferred to the surrounding blood and to minimally increase the overall cross-sectional area. Since the heating filament does not directly touch the patient's blood, the outer surface may be made smooth so as to prevent inducement of blood clots. In addition, the heating filament may be maintained at a safe temperature by forming the heating element of a flexible material having a high temperature coefficient of resistance, low thermal capacitance and high thermal conductivity. Preferably, the temperature coefficient of resistance of the material forming the heater filament is greater than 0.001 Ω/Ω-°C and the resistance of the heating filament is proportional or inversely proportional to its temperature. By monitoring this resistance, the application of power to the heating filament may be regulated to prevent overheating of the heating filament. Calibration techniques are also disclosed whereby a memory containing encoded calibration information is disposed within or connected to a connector of the catheter. This memory may also include a program segment used by a cardiac output computer having a cardiac output calculation program, whereby the portion of code stored in the memory must be input into the cardiac output computer before the determination of the cardiac output can be performed. As a result of these improvements, the invention enables the thermodilution cardiac output calculation to be performed quite safely and accurately in a clinical setting.